ACCELERATION SIMULATION MODE (ASM) TEST

INSPECTORS' GUIDE

Texas Department of Public Safety

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GLOSSARY OF TERMS AND ACRONYMS

25/25
The moderate load / moderate speed (25 mph) portion of the ASM test.

50/15
The high load / low speed (15 mph) portion of the ASM test.

5-Gas Emissions Analyzer
The 5-gas emissions analyzer measures Hydrocarbons (HC), Carbon Monoxide (CO), Nitric Oxide (NO), Carbon Dioxide (CO_2), and Oxygen (O_2). To analyze the various gases, the emissions analyzer uses different technologies to detect and measure their presence in vehicle exhaust:

- Non-dispersive infrared technology measures HC, CO, and CO_2.
- An NO cell measures nitric oxide. The NO cell must be replaced periodically.
- An O_2 cell measures oxygen. The O_2 cell also requires periodic replacement.

ASM EIS -- Texas ASM emissions inspection system
The primary components of the ASM EIS are the dynamometer and 5-gas exhaust analyzer. The dynamometer or "rolling road" is used to simulate on-road driving conditions. The 5-gas analyzer measures NOx as well as HC and CO emission levels.

ASM test – Acceleration Simulation Mode test
With the ASM test, HC, CO and oxides of nitrogen (NOx) emissions are measured during two modes: a high load / low speed condition (the 50/15 test) and a moderate speed / moderate load condition (the 25/25 test).

CO – Carbon Monoxide

Cutpoints
Emission standards used to determine if a vehicle passes or fails an emissions test.

Dynamometer
The dynamometer or "rolling road" is used to simulate on-road driving conditions. The ASM EIS dynamometer includes a fixed inertia weight (equivalent to 2,000 pounds of inertia), a power absorption unit (PAU), a torque measurement system (PAU Load Cell), a speed encoder, drive rolls, a warm up motor, and a platform lift.

HC – Hydrocarbons
HC and NOx react in the atmosphere to form ozone (smog).

Fixed Inertia Weight
The ASM EIS dynamometer uses a fixed inertia weight. By using the power absorption

unit, the dynamometer simulates inertia for vehicles weighing more than 2,000 lbs. The system electrically simulates additional inertia capability without the added cost of multiple flywheel weights.

NO – Nitric Oxide
The ASM test system measures concentrations of NO in the exhaust.

NOx – Oxides of Nitrogen
NOx includes: NO and NO2 (nitrogen dioxide). About 90% of the NOx emissions are NO. HC and NOx react in the atmosphere to form ozone (smog).

PAU – Power Absorption Unit
The PAU has iron rotors and stationary field coils, which apply a vehicle-specific load to the dynamometer.

PSI – pounds per square inch (a unit of pressure)

Rolls
The dynamometer has two sets of rolls to support the vehicle's drive wheels.

RPM
Engine speed in revolutions per minute

TNRCC – Texas Natural Resource Conservation Commission

TSI test – Two-Speed Idle test
With the TSI test, hydrocarbons (HC) and carbon monoxide (CO) concentrations are measured at idle and high idle (2500 rpm) conditions.

Vehicle Restraints
Devices used to keep vehicle from moving when it's on the dynamometer. The ASM EIS includes three types of vehicle restraints: ratcheting tie-down straps, wheel chocks, and lateral wheel restraints.

VIR – Vehicle Inspection Report

1.0 ASM TEST BACKGROUND – WHY IS TEXAS CHANGING FROM AN IDLE TEST TO ASM TEST?

Texas is upgrading the Inspection/Maintenance (I/M) programs in the Dallas, Ft. Worth and Houston Metropolitan areas. Vehicles currently receive a Two-Speed Idle (TSI) test; those that exceeded emission standards (cutpoints) are required to be repaired and retested. With the Two-Speed Idle (TSI) test, hydrocarbons (HC) and carbon monoxide (CO) concentrations are measured at idle and high idle (2500 rpm) conditions. In the future, vehicles will receive an Acceleration Simulation Mode (ASM) test. With the ASM test, HC, CO and oxides of nitrogen (NOx) emissions are measured during two modes: a high load / low speed condition (the 50/15 test) and a moderate speed / moderate load condition (the 25/25 test).

Compared to the current TSI test, the ASM test identifies a lot more emission-related problems and it is much more difficult to get a vehicle to pass it without performing necessary repairs. With the TSI test emissions of NOx can not be evaluated, since a vehicle must be operated under load before NOx emissions can be accurately assessed. NOx along with HC are major ingredients of smog. The ASM test measures NOx along with HC and CO emissions. In addition, the TSI test does not identify as many HC and CO problems as the ASM test, because many problems do not show-up during idle and high idle conditions. Also with the TSI test, inspectors can mask problems that are identified during idle and high idle tests with temporary measures, such as inducing a vacuum leak that masks a rich engine condition.

This manual was developed to familiarize you with the ASM test. The next section provides general information about the ASM test. Detailed procedures to perform the Texas 2-mode ASM test are then presented, followed by a section on maintenance and calibration of the ASM analyzer. This manual is not intended to be a substitute for the manufacturer’s manual.

2.0 GENERAL INFORMATION ABOUT THE ASM TEST

Following is description of the different components of the Texas ASM emissions inspection system, termed ASM EIS. A list of daily equipment checks and safety checks is then presented.

2.1 ASM Test Components

The primary new components of the ASM test system are the dynamometer and 5-gas exhaust analyzer. The dynamometer or "rolling road" is used to simulate on-road driving conditions. The 5-gas analyzer measures NOx as well as HC and CO emission levels.

ASM EIS Dynamometer

The ASM EIS dynamometer includes a fixed inertia weight (equivalent to 2,000 pounds of inertia), a power absorption unit (PAU), a torque measurement system (PAU Load Cell), a speed encoder, drive rolls, a warm up motor, and a platform lift.

This section describes the dynamometer's major components:

Rolls: The dynamometer has two sets of rolls to support the vehicle's drive wheels (see Figure 1). By coupling the front and rear rolls together, dynamometers actually have *two* sets of load rolls. This linkage allows you to test vehicles in either direction on the dynamometer.

Fixed Inertia Weight: The ASM EIS dynamometer uses a fixed inertia weight. By using the power absorption unit, the dynamometer simulates inertia for vehicles weighing more than 2,000 lbs. The system electrically simulates additional inertia capability without the added cost of multiple flywheel weights.

Power Absorption Unit (PAU): The PAU has iron rotors and stationary field coils, which apply a vehicle-specific load to the dynamometer (see Figure 1). The PAU cover houses high-voltage components. Use extreme caution when removing it from the dynamometer.

Figure 1. Dynamometer Rolls and Power Absorption Unit (PAU)

Dynamometer Lift System: The ASM EIS uses a software-controlled lift system to allow vehicles to drive on and off the dynamometer. Raising the lift locks the rolls in place, which enables the operator to drive the vehicle on and off the rolls. Lowering the lift platform unlocks the rolls, which releases them to spin freely during vehicle testing.

Torque measurement system: The torque measurement system uses a strain gauge (load cell) that converts mechanical force (torque) into an equivalent electrical signal.

The host computer then converts this electrical signal into a torque value. Using the torque value and drive roll speed, the host computer calculates vehicle horsepower.

Whenever the lift is down and the rolls are stationary, the analyzer automatically zeroes the torque measurement system. Additionally, the torque measurement system must be calibrated at least every three days. ASM EIS software guides you step-by-step through this procedure.

Vehicle Restraints

The ASM EIS includes three types of vehicle restraints: ratcheting tie-down straps, wheel chocks, and lateral wheel restraints (see Figure 2).

Never operate an unrestrained vehicle on the dynamometer rolls! Vehicles normally move laterally (side-to-side) on the dynamometer. Front-wheel drive vehicles *must be* restrained from moving laterally on the dynamometer.

Figure 2. Vehicle Restraints

All vehicles must be restrained in *all* directions (side-to-side, as well as forward and backward). Use tie downs, floor anchors, and wheel chocks, in addition to the lateral restraints to secure the vehicle. For front wheel drive vehicles only, apply the parking brake to further restrain the non-drive wheels.

Check the condition of the parking brake before applying. Corrosion may cause the parking brake to lock up, making it difficult to release the brake.

Engine Cooling Fan

As a vehicle moves down the road, air flow cools the engine. The Cooling Fan simulates this airflow during a dynamometer test.

5-Gas Emissions Analyzer

The 5-gas emissions analyzer measures Hydrocarbons (HC), Carbon Monoxide (CO), Nitric Oxide (NO), Carbon Dioxide (CO_2), and Oxygen (O_2). NO emissions are used as a surrogate for NOx emissions, since about 90% of NOx emissions are NO. To analyze the various gases, the emissions analyzer uses different technologies to detect and measure their presence in vehicle exhaust:

- Non-dispersive infrared technology measures HC, CO, and CO_2.
- An NO cell measures nitric oxide. The NO cell must be replaced periodically.
- An O_2 cell measures oxygen. The O_2 cell also requires periodic replacement.

2.2 Daily Equipment Inspection

The inspector should step through the following procedure at least once a day to verify that the ASM EIS is in satisfactory working condition:

1. Check the condition of all communication cables that run between the host computer and the dynamometer control box. Also check the integrity of all cable connections. Kinks, cuts and other signs of damage can cause inaccurate test results.

2. Inspect the ASM EIS exhaust connections, sample hose, and probe. Repair or replace worn or damaged parts as necessary.

   Damaged exhaust handling components or poor hose connections can leak toxic tailpipe emissions into the shop air, posing a safety hazard to shop personnel. Always repair exhaust leaks before operating the ASM EIS.

3. Verify the air line pressure is between 80 and 100 psi. Also verify that air lines are regulated and the air supply is dry (i.e., water trap installed and maintained regularly). Turn the air supply "ON" and check for leaks.

   Do not allow the air pressure to exceed 100 psi. Using air pressure greater than 100 psi may result in damage to the dynamometer lift system.

4. Turn the analyzer "ON" and verify the printer, host computer, and monitor are responding and operating properly.

2.3 General Safety Tips

The following safety tips must be followed to assure the safety of the inspector

- Inspect test vehicle tires for tears, blemishes, proper inflation and size uniformity before driving the vehicle onto the dynamometer. If necessary, make repairs or replacements before you begin testing. Also, Inspect test vehicle for fluid leaks before driving it onto the dynamometer. Make repairs before you begin testing. NEVER make repairs to the vehicle's engine or engine compartment when the dynamometer is in use.

- NEVER operate the dynamometer without first restraining the vehicle. Connect all restraints, placing wheel chocks in front and behind the non-drive wheels of the test vehicle. Make sure the floor is clean and dry to keep the wheel chocks firmly in place.

- NEVER operate the vehicle in reverse on the dynamometer, except when removing the vehicle. Always raise the lift before exiting the vehicle from the dynamometer.

- The vehicle operator MUST remain in the driver's seat at all times during a drive cycle test. Do NOT attempt to get in or out of the vehicle while the dynamometer rolls are moving.

- NEVER operate the dynamometer without its cover panels in place. Using a dynamometer with exposed cavities and operating components can be extremely hazardous. Clearly demarcate the test area and install protective guard railings, for your protection and that of your personnel.

- NEVER allow personnel to stand on, or make physical contact with, the dynamometer when raising or lowering the lift. The lift can produce more than 6,000 lbs. of lifting force and several places exist where hands and feet could be trapped and crushed.

- During dynamometer operation, personnel must maintain proper clearance. Allow at least four feet of clearance to the front, rear and sides of the dynamometer. Stay clear of the rolls, especially when the dynamometer is in use.

- Beware of projectiles. Tires rotating at high rates of speed can throw off stones and other embedded objects. Wear approved safety glasses when in the vicinity of a vehicle under test.

- NEVER slam on the vehicle brake when the wheels are in motion on the dynamometer. The vehicle's brakes can produce rates of deceleration equal to several hundred horsepower, capable of propelling the vehicle off the dynamometer rolls. A vehicle exiting the dynamometer in this manner may incur property damage

and injury to personnel, snap the roll-to-roll drive coupling belt, and cause damage to internal dynamometer components.

- Do NOT block the Power Absorption Unit (PAU) cover vents with paper, cloth, boxes, etc. Air must be able to pass through these openings. Be aware that the PAU cover becomes extremely hot during dynamometer operation. Use caution when near the PAU to avoid burns.

- With above ground installations, ALWAYS use extreme caution when driving on and off the ramps and platforms. Failure to do so may result in the test vehicle exiting the dynamometer, platforms, or ramps improperly and unsafely.

- NEVER test Traction-Control or All-Wheel Drive vehicles on a single-axle, two-wheel drive dynamometer. Viscous couplings on many modern all-wheel drive systems tend to overheat, and may incur permanent damage as a result.

- Always properly vent the exhaust gases during all emissions tests.

Figure 3. Venting Exhaust Gases

3.0 ASM (LOADED MODE) EMISSIONS TEST SEQUENCE

1. Pre-Test Vehicle Inspection

To prevent vehicle damage, it is very important to conduct a thorough vehicle inspection before performing ASM testing. Problems with the vehicle can permanently damage the vehicle or the ASM EIS.

a. Confirm both drive wheel tires are the same size. Adjust the tire pressure to the vehicle manufacturer's specification (or as shown on the tire sidewall) and inspect the tread for defects, bulges, or tire cord protrusions.
b. **Do *not*** operate the vehicle on the dynamometer if a temporary spare tire ("space-saver") is installed on one of the vehicle's drive wheels, if tire cord is visible on any of the tires, or if there are any other tire defects.
c. Inspect the vehicle for fuel, coolant, and oil leaks.
d. **Do *not*** operate a vehicle on the dynamometer if it leaks fluid. Make sure vehicle fluid levels (oil, transmission, coolant, power steering, etc.) meet the vehicle manufacturer's requirements.
e. Inspect the vehicle for exhaust leaks. Repair any leaks before performing tests to prevent sample dilution errors and ensure accurate test results.

Before testing, make certain that the vehicle can be safely tested on the dynamometer. **Do not** test vehicles on the dynamometer that have any of the following characteristics: full-time four-wheel drive, all-wheel drive, non-disengageable traction control, or a per-axle weight greater than 6,000 lbs.

Use caution when testing vehicles equipped with antilock brakes. ABS vehicles may set OBD trouble codes when driven on a two-wheel drive dynamometer. Follow the vehicle manufacturer's recommended procedures for clearing trouble codes.

2. Enter Vehicle Parameters

The inspector must first enter the vehicle identification number (VIN), plate, along parameters describing the vehicle. Vehicle parameters are used to determine the Equivalent Test Weight (ETW) and pass/fail standards.

- ETW is used to set the dynamometer loadings.
- Pass/fail standards depend on age, vehicle type, and ETW.

3. Positioning Vehicle on the Dynamometer

The ASM EIS will prompt the inspector to drive the vehicle onto the dynamometer and laterally stabilize, restrain, and chock the vehicle. Carefully follow the procedure below to position the vehicle on the dynamometer. By doing so, you ensure accurate testing results and safe operation of the ASM EIS.

Do not place a vehicle with a per-axle weight greater than 6,000 lbs. on the dynamometer! Excessive weight damages the lift system.

a. Conduct a thorough pre-test vehicle inspection and make any necessary repairs.
b. Select the desired test from the Test Menu or Manual Test Menu and enter the required vehicle information.
c. Make certain the dynamometer lift plate is up. Raise the lift.
d. Clear obstructions away from the driving path to the dynamometer.

    Remove the lateral wheel restraints if they are attached to the dynamometer. Driving the vehicle onto the dynamometer when the restraints are in place can damage the vehicle and the lateral wheel restraints.

e. Position the vehicle's drive wheels in front of and square with the dynamometer rolls. If necessary, ask an assistant to direct you.
f. Slowly drive the vehicle's drive wheels into position on the dynamometer rolls.
g. Lower the lift.
h. Restrain and align the vehicle on the dynamometer rolls.

4. Restraining the Vehicle

The ASM EIS will provide the following screen prompts:

Screen Prompt:

IS THE VEHICLE A FRONT-WHEEL DRIVE? (YES/NO)

a. **Front-Wheel Drive**

1) If YES (the vehicle is a front-wheel drive vehicle), the ASM EIS will prompt the driver to laterally stabilize, restrain and chock the vehicle on the dynamometer if it has not already been done.

Screen Prompt:

FRONT-WHEEL DRIVE VEHICLE: LATERALLY STABILIZE, RESTRAIN AND CHOCK.

Verify that the restraints are engaged (by a positive answer to a prompt) prior to preceding to the next step.

Restrain and align the vehicle on the dynamometer rolls as follows:

A. Apply the brakes.

B. Shift the transmission to “Drive” for automatic transmissions or “First” for manual transmissions.

C. *Slowly* release the brake or clutch so the tires rotate very slowly. **Do not exceed 3 mph!**

D. Gently apply the brake once the vehicle settles.

E. Shift the transmission to “Park” for automatic transmissions or “Neutral” for manual transmissions.

F. Apply the parking brake to restrain the non-drive wheels.

G. Turn the engine off.

H. Visually check the vehicle’s alignment with the dynamometer rolls. Also, make sure the wheels clear the dynamometer frame.

If the vehicle is not correctly aligned with the rolls, raise the dynamometer lift. Slowly drive the vehicle off the dynamometer and repeat the above steps to reposition the vehicle.

b. **Rear-Wheel Drive**

2) If No (the vehicle is a rear-wheel drive vehicle), the driver will be prompted to restrain the vehicle.

Screen Prompt:

REAR-WHEEL DRIVE VEHICLE: RESTRAIN AND CHOCK.

5. Positioning Cooling Fan

The analyzer will prompt the technician to turn on the fan and place it in position if the ambient temperature is above 72^{o}F. (The ASM EIS may provide the option of automatically turning on the fan from a remote location.)

6. Obtaining RPM Signal

The ASM EIS will provide the following screen prompt:

Screen Prompt:

SELECT RPM PICK-UP DEVICE

1. CONTACT
2. NON-CONTACT
3. OBD II PORT
4. OTHER

a. The technician will be given the opportunity to select another RPM pick-up device and continue with the current inspection (without causing the test to abort, if the RPM is not detected).

b. RPM will be displayed during the emissions test. Instability will be immediately detected and displayed on the screen.

Screen Prompt:

UNSTABLE RPM SIGNAL – CHECK OR CHANGE PICK-UP

1. A stable RPM signal is required to complete the emissions test. Manufacturers may propose an error tolerance factor to be used when testing vehicles with unstable RPM signals.

2. For OTHER RPM pick-up devices, the ASM EIS manufacturer may develop a unique engine RPM pick-up.

7. Probe Insertion

The software will prompt the technician to insert the sample probe into the tailpipe.

8. Gear Selection

The technician will be prompted, as appropriate, on transmission type:

a. Automatic Transmissions

Screen Prompt:

PLACE THE TRANSMISSION IN DRIVE. IF THE ENGINE RPM EXCEEDS _____, PLACE THE TRANSMISSION IN OVERDRIVE. (Value will be shown by test system)

b. Manual Transmissions

Screen Prompt:

PLACE THE TRANSMISSION IN SECOND GEAR.
KEEP ENGINE RPM BETWEEN ____ AND ____RPM. (Value will be shown by test system)

9. Tire Drying

The analyzer will prompt the technician as follows:

Screen Prompt:

DO THE TIRES NEED DRYING? (YES/NO)

If NO, the analyzer will proceed to the next step. If YES, the analyzer will require the technician to run the vehicle at any speed below 30 mph after selection of the transmission gear (engine speed may not exceed 3000 RPM) for a period from 15 to 30 seconds. When the roll speed exceeds 1 mph, the screen will display the following delay message which will include the seconds that must be waited until the test mode can begin.

Screen Prompt:

ONCE THE TIRES ARE DRY, YOU MUST WAIT AT IDLE FOR ____ SECONDS PRIOR TO BEGINNING THE PRECONDITIONING MODE. (Value will be shown by test system)

The software will increment the above second timer one second at a time, not to exceed 30 seconds, until the rolls are brought to a stop (speed reaches 1 mph or less). If the vehicle speed exceeds 30 mph or the engine exceeds 3000 RPM during tire drying, the timer will increment twice a second until the speed is brought below 30 mph or the engine speed below 3000 RPM. When the rolls come to a stop, the above timer will decrement once every second until the time

reads zero before the ASM EIS allows the driver to start the 50/15 mode. At the same time, display the following prompt:

Screen Prompt:

DO THE TIRES NEED MORE DRYING? (YES or NO)

If NO, the analyzer will proceed to the next step (after any required waiting time) in the testing procedure.

10. ASM Pre Emissions Test Conditions

The following conditions must be met before the ASM EIS begins the test sequence:

a. Zero air, electronic span, ambient air, and hang up checks have been performed.

b. The ASM EIS does not detect a "low-flow" or diluted exhaust condition.

c. The engine idle speed is between 400 and 1250 RPM.

d. The dynamometer rolls are not turning (speed <1 mph). If the roll speed exceeds this limit, or the engine speed exceeds 1250 RPM, display the following delay message and increment the displayed seconds by two times the number of seconds the roll or engine speed are outside limits (not to exceed 30 seconds).

Screen Prompt:

DELAY TESTING, YOU MUST WAIT ____ SECONDS. (Value will be shown by test system)

11. Preconditioning

Once the test conditions in (10) are met, the inspector will be prompted to begin the preconditioning sequence. This is done to ensure accurate gas readings. Refer to the following procedure to precondition (warm up) the vehicle.

Do *not* perform the preconditioning procedure unless you have connected the mandatory safety restraints to the vehicle!

Preconditioning procedures

The analyzer will display the following prompt:

Screen Prompt:

PRECONDITIONING CAN BEGIN. ACCELERATE GRADUALLY TO 15 MPH

If, at any time during the preconditioning mode, the speed and RPM criteria or the gear selection criteria fall outside the acceptable ranges, the software will display one of the following appropriate messages to prompt the driver to correct the problem.

Screen Prompt:

OUTSIDE PRECONDITIONING SPEED LIMIT
LOW FLOW/OUTSIDE DILUTION SPECIFICATION
OUTSIDE ENGINE RPM RANGE
DYNO LOADING ERROR

The "dyno loading error" will be displayed if the ASM 50/15 load tolerances are exceeded. A dyno loading error requires correction only if it is outside preconditioning tolerances or if it is outside the ASM tolerances while the speed and RPM are within the ASM 50/15 tolerances.

12. ASM (Loaded Mode) Emissions Testing Sequence

When the preconditioning sequence at ASM 50/15 speed and load has been successfully completed, the inspector will be prompted that the ASM 50/15 test has begun. The ASM test timer will start (tt=0) when the vehicle speed, engine rpm, dyno loading and dilution are within the test limits for five (5) seconds.

a. 50/15 Test Mode (ASM Test Mode 1)

At the conclusion of the preconditioning mode the software will prompt the driver to maintain the vehicle at 15 mph ± □1 mph. The software will display the 50/15 test speed with applicable speed limits (or drive trace graphical display), test time, engine RPM and other appropriate test mode information. The dynamometer will meet the 50/15 test mode tolerances throughout the 50/15 test mode. The 50/15 mode will begin (mt=0) when the roll speed (and corresponding power) is stabilized at 15 ± □□1 mph for five consecutive seconds (which may include the last 5 seconds of the preconditioning mode if the 50/15 tolerances have been met for those 5 seconds).

The software will display the 50/15 test speed with applicable speed limits (or drive trace graphical display), test time, engine RPM, and other appropriate test mode information.

The maximum duration for the 50/15 test mode is 90 seconds. The emissions averaging portion of the test (when emission levels are assessed) will not begin unless:

- Engine speed (manual transmission only) is within required engine RPM range.
- Load and dilution (CO + CO_2) fall within specifications.

If the vehicle has not stabilized in accordance with the above criteria within 25 seconds, the analyzer will prompt the technician to restart the test according to the restart procedures listed later.

If the instantaneous dynamometer loading, as measured by the dynamometer load cell, differs from the command load by more than □0.25 hp or □2% whichever is greater for more than two consecutive seconds or more than 5 seconds total during the emissions averaging portion of the ASM 50/15 test, the ASM EIS will set a dynamometer loading error. This will cause the test mode to restart according to the restart procedures.

The vehicle will pass the ASM 50/15 mode and the mode will be immediately terminated if, at any point between an elapsed time of 15 seconds and 90 seconds, the 10 second running average measured values for each pollutant are simultaneously less than or equal to the applicable test standards. Once passing readings have been achieved for all three gases, the 50/15 mode will terminate and the ASM EIS will proceed to the next phase of the test.

If, at any time during the emissions-averaging portion of the test mode, test criteria fall outside the acceptable ranges, the software will display one of the following appropriate messages to prompt the driver to correct the problem.

Screen Prompt:

OUTSIDE TEST SPEED LIMIT
OUTSIDE ENGINE RPM RANGE
DYNO LOADING ERROR
LOW FLOW/OUTSIDE DILUTION SPECIFICATION

If at any time the acceleration exceeds TNRCC's limits, software will display the following message to prompt the driver that the acceleration is out of range:

Screen Prompt:

OUTSIDE THE MAXIMUM ACCELERATION LIMIT

b. **25/25 Test Mode (ASM Test Mode 2)**

The 25/25 test mode procedures are the same as those for the 50/15 test mode, except for the following:

The inspector will be prompted to increase speed to 25 mph. The dynamometer torque will smoothly transition during the acceleration period and will automatically reset to the load required for the 25/25 mode once the speed reaches 25 mph.

The 25/25 mode will begin when the roll speed (and corresponding power) is stabilized at 25 mph ± □1 mph for five consecutive seconds.

A vehicle will pass the 25/25 test mode if the 10-second average readings for HC, CO and NOx are all equal to or below the applicable standards for the vehicle. Once readings have been achieved for all three gases, the 25/25 mode will terminate and the ASM EIS will proceed, if applicable, to the second chance phase of the test.

Figure 4. Example of Analyzer Screen During ASM 25/25 Test

13. Second Chance Tests.

If all emissions results (HC, CO, and NOx) for both ASM Modes are within 150% of the applicable standards, the vehicle is entitled to a second chance test. If an ASM mode is authorized for a second chance test, only the results of the second chance test for that mode will be written to the Vehicle Inspection Report (VIR).

If the vehicle failed only the ASM 50/15 test (within 150% of all standards) of the first chance test, then that mode will be repeated upon completion of the second mode (ASM25/25). The test will terminate when the mode ends or when the vehicle passes, whichever occurs first.

Screen Prompt:

SECOND CHANCE 50/15 TEST AUTHORIZED. PLEASE GRADUALLY DECELERATE TO 15 MPH AND REPEAT THE ASM 50/15 MODE.

Screen Prompt:

SECOND CHANCE 25/25 TEST AUTHORIZED. PLEASE CONTINUE SPEED AT 25 MPH.

If the vehicle failed both modes (ASM50/15 and ASM 25/25) of the first chance test, then the vehicle will receive a second-chance test for the ASM50/15.

Screen Prompt:

SECOND CHANCE 50/15 TEST AUTHORIZED. PLEASE DECELERATE GRADUALLY TO 15 MPH AND REPEAT THE ASM 50/15 MODE.

If the vehicle fails the second-chance ASM50/15, then the vehicle will fail the test. Otherwise, the vehicle will also receive a second-chance ASM 25/25. If the vehicle fails the ASM 25/25 second chance test, the vehicle will fail the ASM test. If the vehicle passes the second chance 25/25 mode and passed the first chance ASM 50/15 mode, the vehicle will pass the ASM test.

The ASM test will terminate and the emissions readings used to make the pass/fail decision will be recorded in the test record and on the VIR.

14. Augmented Braking

Augmented braking will be operational during the ASM test. Augmented braking for the ASM test consists of applying the maximum safe load with the dynamometer to bring the

rolls to a complete stop. Augmented braking will automatically occur when any of the following conditions are met:

a. The conclusion of the final test mode (including second chance tests)
b. The test mode meets conditions for restart
c. The test mode meets conditions for abort

The ASM EIS will disengage the augmented braking if the technician chooses. The augmented braking will default to the engaged position.

15. Restart Procedures

If the test parameters fall out of pre-determined limits, the test must be restarted, as discussed below:

a. Bring the rollers to a full stop.
b. The software will prohibit the restart of the test until the vehicle has idled (speed <1250) until twice the original elapsed time from the start of the ASM 25/25 or one minute (whichever is less).
c. The dynamometer load will be applied when the speed reaches 10 mph and will smoothly transition until the speed reaches 15 mph or 25 mph as applicable.

Screen Prompt:

TEST MODE MUST BE RESTARTED BECAUSE:

a. Conditions Causing Test Mode Restart (either mode):

i. Vehicle and/or equipment unable to stabilize with required stabilization time.
ii. Acceleration violation according to the requirements stated in the test sequence.
iii. Dynamometer load outside of specification for two (2) or more consecutive seconds, or more than five (5) seconds total.
iv. Sample dilution.
v. Engine speed below 100 RPM for more than two (2) seconds.
vi. Inadequate number of valid ten-second average readings.
vii. Analyzer “low flow” condition for two (2) or more consecutive seconds.
viii. Vehicle speed outside test limit for two (2) or more consecutive seconds.

ix. Engine speed outside of range for five (5) or more seconds during one excursion.

The maximum number of restarts is two (2), otherwise the test will be aborted.

b. Conditions Causing ASM Test Abort (both modes):

i. Safety-related issues
ii. Equipment failure
iii. Power loss
iv. Any of the restart conditions listed above.

16. End of ASM Emissions Test Mode

At the completion or termination of the ASM two-mode inspection, the analyzer will display the following message:

Screen Prompt:

END OF ASM EMISSIONS TEST
REMOVE RESTRAINING SYSTEM FROM VEHICLE.
REMOVE COOLING FAN, TACHOMETER LEAD AND SAMPLE PROBE.

4.0 MAINTENANCE AND CALIBRATION OF ASM EIS

4.1 Maintenance Safety For The ASM EIS Dynamometer

Warnings:

DYNAMOMETERS CAN BE DANGEROUS IF MAINTENANCE IS NOT PERFORMED PROPERLY!

READ THE SAFETY ADVISORIES BELOW BEFORE PERFORMING MAINTENANCE ACTIVITIES.

Electrical Shock Hazard. Turn off electrical service to the system before performing any maintenance activity. Turn off the main breaker in the breaker box before working on anything related to the PAU. The power input is 240 VAC, 30 Amps. The output to the PAU ranges from 0 to 80 VDC.

No Jewelry. Before performing any electrical or mechanical troubleshooting, repair, etc. on the dynamometer, remove all jewelry.

Dynamometer Cover Panels. When performing maintenance on the dynamometer, use extreme caution near drive mechanisms and moving parts -- especially after removing any of the cover panels.

Avoid Straining Yourself. Be careful when lifting the PAU cover; it is large and heavy. Be very careful when replacing belts, couplings, or bearings -- the rolls are very heavy and can be difficult to handle.

Watch Your Hands. Never put your hand between the lift beam and roll with the air connected to the system. The lift could release, trapping and crushing hands and fingers.

Air Pressure. Make sure no air pressure is in the lines when working near the lift, brakes or air bellows.

NEVER, NEVER, NEVER pull on the drive belt in order to spin the rolls! Failure to release the belt may trap fingers between the pulleys and drive belt. The force is strong enough to sever fingers from the hand.

Water Accumulation. Do not allow water accumulation in the dynamometer pit! Water, dripping vehicle fluids, and floor cleansers may collect in the dynamometer pit. If fluid depth in the pit exceeds 1/2 inch, the spinning Power Absorber Unit rotors suction the fluid, spraying the PAU, nearby electronic components and voltage connections.

Destruction of the PAU and/or other electric or electronic components and wiring results. To avoid water damage, periodically use a sump pump or shop vacuum to suction fluids from the pit. Regardless of the fluid removal method you choose, you must dispose of the fluids in accordance with local and Environmental Protection Agency (EPA) regulations governing collection and disposal of toxic wastes.

4.2 Calibration Procedures

Gas Calibration

The analyzer calibrates itself using specially formulated gases that are certified for concentration. These gases are stored in bottles inside the lower compartment of the unit.

If the sample hose is set up for dual exhaust testing, remove the dual exhaust assembly and install a probe on the end of the standard hose before running the calibration procedures.

When running the gas calibration procedures, you will be prompted to open the valves on the calibration gas bottles. If any gas bottle gauge reads less than 15 PSI, replace that bottle. Replacement bottles are available from any authorized service center. Always close the gas bottle valves as prompted after each procedure has been completed.

Procedures

1. The “Gas Calibration” screen will be displayed and a window will appear announcing the beginning of the gas bench calibration.

2. The “High Cal Gas Cylinder Values” window will appear, prompting you to scan the first of the high-range bar codes (located on the high gas bottle label) with the bar code reader.

If the bar code reader is unavailable, press [ENTER] to type in the cylinder values using the keyboard.

Follow the same procedure for the second and third high-range bar codes as prompted by the display screens.

3. The “Low Cal Gas Cylinder Values” window will appear, prompting you to scan the first of the low-range bar codes (located on the low gas bottle label) with the bar code reader.

Follow the same procedure for the second and third low-range bar codes as prompted by the display screens.

4. The “Zero Cal Gas Cylinder Values” window will appear, prompting you to scan the first of the zero-range bar codes (located on the zero gas bottle labels) with the bar code reader.

Follow the same procedure for the second and third zero-range bar codes as prompted by the display screens.

5. The analyzer will prompt you to turn on the calibration gases. Open the valves on the gas bottles inside the lower compartment of the unit. Check the pressure gauges. If any of the gauges read below 15 PSI, replace that bottle.

6. The analyzer will then display a series of progress messages as it completes the gas calibration process.

If the display shows an error message, follow the instructions on the display screen and check the analyzer. Make sure that **all** gas bottle valves are open! (Turn the valves counterclockwise.)

7. When the gas calibration has been completed, you will be presented with a window instructing you to close the calibration gas bottle valves.

Another window will appear with a message indicating that the gas calibration was successful.

8. The screen will display the gas calibration results.

Sample System Leak Check

1. Follow the on-screen prompt and push the plastic cap firmly over the end of the exhaust probe.

As the test is begun, a “Leak Test In Progress” message will appear at the bottom of the screen.

2. If no leaks are found, the screen will announce that the leak check passed, and prompt you to remove the probe tip cap.

If a “Leak Check Failure” message is displayed, follow the on-screen instructions and run the test again. If the message persists, you must get the analyzer serviced.

Dynamometer Calibration

1. The dynamometer calibration routine will begin with a message window prompting

you to confirm that the dynamometer has no vehicle on its rollers.

If you are presented with a message informing you that the dynamometer needs to be warmed up, follow the on-screen prompts to initiate the dynamometer warm-up sequence.

2. A window will appear, warning that the dynamometer is about to begin moving, and that all personnel should stand away from the spinning rollers.

3. The “Coast-Down Test” window will appear, displaying the dynamometer’s current and target velocities. Once the “Present Velocity” reaches 33.0 mph, the dynamometer’s speed will decrease and the coast-down times will be measured against the required specifications.

4. After the first coast-down test has been completed, the “Safety Warning” window will appear again, reminding personnel to stand clear of the rollers.

5. You will be presented with another “Coast-Down Test” window, displaying the current and target velocities. Once the “Present Velocity” reaches 23 mph, the dynamometer’s speed will decrease, and the coast-down times will be measured against required specifications.

6. If the dynamometer coast-down times are within the specified limits, then a “Calibration Message” window will appear displaying the message “Calibration Routine Successful.”

7. If the dynamometer coast-down times are not within the specified limits, a window will appear with a message explaining that the coast-down test has failed. The failure could be due to incorrect parasitic loss values. You will then be prompted to begin the parasitic losses calibration routine.

8. The “Parasitic Losses Calibration Window” will appear, displaying the velocity measurements in mph. Once the “Present Velocity” reaches 33.0 mph, the dynamometer’s speed will decrease and the parasitic losses will be measured against the recommended limits.

9. Once the dynamometer parasitic losses are within limits, you will be prompted to run another coast-down check using the new parasitic loss values.

10. The “Coast-Down Check-2nd Pass” window will appear displaying the dynamometer’s current and target velocities. At this point the coast-down procedure will be repeated.

If the dynamometer coast-down times are within the specified limits, then a “Calibration

Routine Successful” message will appear.

If the coast-down times are not within manufacturer required specifications, a “Calibration Error” message will appear, informing you that the coast-down test has failed again. This could be due to inaccurate load cell calibration. The dynamometer package does not include the calibration weights that are necessary to correct this problem. You will need to contact your service representative.